

CLAIMS

What is claimed is:

- 5 1. A method of testing operational boundaries comprising:
 discovering an operational range over a plurality of varying
 operating parameters for a device by testing points, as defined by said
 plurality of varying operating parameters, to discover an operational
 boundary of said device that comprises a plurality of boundary points just
 10 outside of said operational range, without testing all of a plurality of
 interior operational points within said operational boundary.
2. The method of testing operational boundaries as described in
 Claim 1, further comprising:
 15 automatically discovering said operational range by automatically
 testing for said operational boundary.
3. The method of testing operational boundaries as described in
 Claim 1, further comprising:
 20 varying a first and second parameter in said plurality of varying
 parameters; and
 holding constant all remaining parameters in said plurality of
 varying parameters.
- 25 4. The method of testing operational boundaries as described in
 Claim 1, further comprising:
 i) beginning from a known interior operational point, testing
 adjacently coupled points in a first direction until an initial failure point is
 discovered, said initial failure point being one of said plurality of boundary
 30 points; and
 ii) from said initial failure point, testing for and discovering each of
 said plurality of boundary points that are adjacently coupled until
 returning to said initial failure point.

5. The method of testing operational boundaries as described in Claim 4, wherein said first direction varies in only one of said plurality of varying parameters in an increasing manner, holding all remaining parameters in said plurality of varying parameters constant.

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6. The method of testing operational boundaries as described in Claim 4, wherein ii) comprises:

beginning from a last known boundary point, testing adjacent points in a circular direction starting from known and adjacent interior operational points until a new failure point is discovered, said new failure point being one of said plurality of boundary points; and

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recursively testing adjacent points in said circular direction with each newly discovered new failure point until again reaching said initial failure point.

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7. The method of testing operational boundaries as described in Claim 6, wherein said circular direction is a clockwise direction.

8. The method of testing operational boundaries as described in Claim 1, further comprising:

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setting an upper and lower limit for each of said varying parameters that define operational limits of said operational boundary, wherein points lying outside of said operational limits are points of operational failure.

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9. The method of testing operational boundaries as described in Claim 1, wherein each of said plurality of boundary points and operational points of failure indicate said device does not successfully boot up and run test applications, and each of said plurality of interior operational points that have been tested indicate said device does successfully boot up and run test applications.

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10. The method of testing operational boundaries as described in Claim 1, further comprising:

determining whether said plurality of boundary points is part of an interior fault region within said operational boundary; and

5 discovering a second operational boundary of said device that comprises a second plurality of boundary points just outside of said operational range if said plurality of boundary points is part of said interior fault region.

11. A method of testing operational boundaries, comprising:

10 a) varying a first and second operating parameter in a plurality of operating parameters, said plurality of operating parameters defining points in an operating region for a device;

 b) beginning from a known operational point of said device, testing adjacently coupled points in a direction until an initial failure point is discovered; and

15 c) from said initial failure point, testing for and discovering each of a plurality of failure points that are adjacently coupled until returning to said initial failure point, said plurality of failure points defining an operational boundary for said device that bounds an operational range comprising a plurality of interior operational points within said operating
20 region for said device.

12. The method of testing operational boundaries as described in Claim 11, wherein a), b), and c) are performed automatically.

25 13. The method of testing operational boundaries as described in Claim 11, wherein said direction varies in said first parameter in an increasing manner, holding all remaining parameters in said plurality of varying parameters constant.

30 14. The method of testing operational boundaries as described in Claim 11, wherein c) comprises:

 beginning from a last known boundary point, testing adjacent points in a circular direction starting from known and adjacent interior operational points until a new failure point is discovered, said new failure
35 point being one of said plurality of boundary points; and

recursively testing adjacent points in said circular direction with each newly discovered new failure point until again reaching said initial failure point.

5 15. The method of testing operational boundaries as described in Claim 11, further comprising:

 d) discovering if said plurality of failure points bound an interior fault region within said operational range; and

 e) testing for a second plurality of failure points if all of known said
10 plurality of interior operational points do not lie within said plurality of failure points.

 16. The method of testing operational boundaries as described in Claim 15, wherein d) comprises:

15 discovering said interior fault region, if a last point that has been tested in a set of adjacent points that are examined from said beginning point to an operational limit in said direction is an operational point.

 17. The method of testing operational boundaries as described in
20 Claim 16, wherein e) comprises:

 beginning from said last point, testing for and discovering each of a second plurality of failure points that are adjacently coupled until returning to said last point, said second plurality of failure points defining a second operational boundary that bounds said operational range within
25 said operating region for said device.

 18. The method of testing operational boundaries as described in Claim 11, wherein said device is a chip forming an integrated circuit.

30 19. The method of testing operational boundaries as described in Claim 11, further comprising:

 discovering the type of fault at each of said plurality of failure points.

20. The method of testing operational boundaries as described in Claim 11, wherein said plurality of operating parameters is taken from a group consisting of:

frequency;
voltage;
current; and
temperature.

21. A computer system comprising:

a processor; and

a computer readable memory coupled to said processor and containing program instructions that, when executed, implement a method of testing operational boundaries comprising:

discovering an operational range over a plurality of varying operating parameters for a device by testing points, as defined by said plurality of varying operating parameters, to discover an operational boundary of said device that comprises a plurality of boundary points just outside of said operational range, without testing all of a plurality of interior operational points within said operational boundary.

22. The computer system as described in Claim 21, wherein said method further comprises:

automatically discovering said operational range by automatically testing for said operational boundary.

23. The computer system as described in Claim 21, wherein said method further comprises:

varying a first and second parameter in said plurality of varying parameters; and

holding constant all remaining parameters in said plurality of varying parameters.

24. The computer system as described in Claim 21, wherein said method further comprises:

i) beginning from a known interior operational point, testing adjacently coupled points in a first direction until an initial failure point is discovered, said initial failure point being one of said plurality of boundary points; and

5 ii) from said initial failure point, testing for and discovering each of said plurality of boundary points that are adjacently coupled until returning to said initial failure point.

25. The computer system as described in Claim 24, wherein said
10 first direction varies in only one of said plurality of varying parameters in an increasing manner, holding all remaining parameters in said plurality of varying parameters constant.

26. The computer system as described in Claim 24, wherein ii) in
15 said method comprises:

beginning from a last known boundary point, testing adjacent points in a circular direction starting from known and adjacent interior operational points until a new failure point is discovered, said new failure point being one of said plurality of boundary points; and

20 recursively testing adjacent points in said circular direction with each newly discovered new failure point until again reaching said initial failure point.

27. The computer system as described in Claim 26, wherein said
25 circular direction is a clockwise direction.

28. The computer system as described in Claim 21, wherein said method further comprises:

30 setting an upper and lower limit for each of said varying parameters that define operational limits of said operational boundary, wherein points lying outside of said operational limits are points of operational failure.

29. The computer system as described in Claim 21, wherein each of
35 said plurality of boundary points and operational points of failure indicate

said device does not successfully boot up and run test applications, and each of said plurality of interior operational points that have been tested indicate said device does successfully boot up and run test applications.

5 30. The computer system as described in Claim 21, wherein said method further comprises:

 determining whether said plurality of boundary points is part of an interior fault region within said operational boundary; and

10 discovering a second operational boundary of said device that comprises a second plurality of boundary points just outside of said operational range if said plurality of boundary points is part of said interior fault region.

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